DOCUMENT RESUME

ED 158 156 CG 012 618

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TITLE You Know More of a Road If You Travel It.
PUB DATE 18 May 78
NOTE 35p.; Paper presented at the Annual Symposium of the Jean Piaget Society (8th, Philadelphia, Pennsylvania, May 18, 1978)

EDRS PRICE MF-$0.83 HC-$2.06 Plus Postage.
DESCRIPTORS *Abstract Reasoning; Cognitive Style; *College Curriculum; College Freshmen; *Experiential Learning; *Group Discussion; Higher Education; *Personality Development; Program Descriptions; Program Evaluation; Social Relations; *Thought Processes
IDENTIFIERS Project ADAPT

ABSTRACT

If academic material is to have the same force as social and personal experience at the college level, then educators need to allow more experiences on the academic road. That experiences are becoming more important is evidenced by the emergence of competency-based programs, experimental teaching programs, cluster colleges, and experiential interludes during the college year. Efforts to add experiences to the college curriculum are also coming from faculty who are disenchanted with providing only conjecture and description. This disenchantment grows out of serious questions about the efficacy of the lecture as the sole vehicle to encourage learning. The ADAPT program at the University of Nebraska represents one possibility for those trying to wed experience and ideas. The ADAPT program encourages students to experience multiple academic disciplines in an abbreviated fashion. Further, within the context of the college classroom these experiences provide the basis for understanding the conjecture and description which is central to the discipline in question. In the following discussion the theoretical rationale for the program is described, and implications for college students are drawn. Specifics of the ADAPT program are outlined and evaluations of the program's first two years are presented. (Author)

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You Know More of a Road If You Travel It

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Paper presented at 8th Annual Symposium of the Jean Piaget Society, Philadelphia, PA, May 18, 1978.

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You Know More of a Road If You Travel It

William Hazlitt, the British essayist commented in 1836 that "You know more of a road by having traveled it than by all the conjectures and descriptions in the world" (Hazlitt, 1836). This statement alludes to the need for experiences to accompany and cement ideas, a notion which still poses one of the central controversies of education. When applied to the college campus one has no trouble locating conjecture and description in the curriculum; but especially during the Freshmen year in college the new roads that are actually being experienced are likely to be in the social and personal area rather than the academic area (Perry, 1968). If academic material is to have the same force as these other areas, then we need to allow more experiences on the academic road. The modern echoes of this view are heard from developmental psychologists as well as educational critics, legislators, regents, and administrators (Brown, 1972a; 1972b; Cross, 1971; Illich, 1971; Reich, 1970; Zigerell, 1971). That experiences are becoming more important is evidenced by (a) the emergence of competency based programs, (b) experimental teaching programs, (c) cluster colleges, and (d) experiential interludes during the college year. Efforts to add experiences to the college curriculum are also coming from faculty who are disenchanted with providing only conjecture and description. This disenchantment grows out of serious questions about the efficacy of the lecture as the sole vehicle to encourage learning.

The ADAPT program at the University of Nebraska represents one possibility for those trying to wed experience and ideas. The ADAPT program encourages students to experience multiple academic disciplines in an abbreviated fashion. Further, within the context of the college classroom these experiences provide the basis for understanding the conjecture and description which is central to the discipline in question. In the following discussion the theoretical

rationale for the program is described, and implications for college students are drawn. Specifics of the ADAPT program are then outlined and evaluations of the first 2 years of the program are presented.

Piagetian Theory

The heart of the ADAPT program is a multidisciplinary curriculum for college freshmen which emanates from Piagetian theory (Ginsburg & Opper, 1969; Inhelder & Pieget, 1958). This curriculum is designed to facilitate movements of students from a thought pattern which Piaget describes as concrete to more formal thought patterns. The kinds of thought processes evidenced during concrete operations are seen as quite limited. The student at this stage is oriented toward the concrete realities of the world and is unable to consider abstract concepts which depart from that reality. In addition there are limits on the performance of such logical operations as reasoning about hypotheses, performing operations of propositional logic, or reasoning about contrary-to-fact situations (Inhelder & Piaget, 19580).

Movement from concrete operations to more formal thought patterns permits the student to shift his limited focus from the concrete realities of the world to a consideration of all the events which might occur. The student who has attained formal operations can understand abstract concepts which depart from concrete reality, and reasoning is no longer limited to extrapolations from sensory experience. The student can now also delineate all the possibilities and think of the observed as a special case of the possible (Inhelder and Piaget, 1958; Neimark, 1975), thus allowing for greater flexibility in thought patterns. This transition in thinking processes seems critical to college success and also essential if the student is to move beyond his own experience in evaluating situations. It also seems apparent that the college

classroom is ideally suited to effect such a change if it can blend experiences familiar to students with abstractions that are not.

Piaget has not only described the change in thinking processes which occurs during adolescence, but he has suggested that the student progresses from concrete operations to formal operations by a particular process, called variously equilibration or self-regulation (Furth, 1969; Karplus, 1974; Langer, 1969; Piaget, 1973). Self-regulation occurs when a student is engaged in learning. When experiences and encounterss confirm ideas or beliefs that have been held in the past, these ideas are stabilized. But when experiences tend to disconfirm a student's ideas, these ideas must be reorganized to deal with the conflict. Such conflict is an impetus for growth and change and leads to a new, more highly differentiated and stable set of ideas. Since individuals never have concepts or methods of organizing the world which are com-let pletely satisfactory, any information which does not fit with an individual's present organizational system can motivate further growth. The self-regulation which occurs is the student's constant monitoring of his own ideas and those ideas which are being presented.

Implications for Education

The earliest work on the transition to formal operational thought assumed that the student acquired the capacity to abstract from concrete experiences and to theorize about the total possibilities or alternatives in a problem before his college years. However, numerous studies suggest that as many as 50 percent of our college freshmen fail to demonstrate these sophisticated thought processes, (Karplus, 1974; Lovell, 1961; Tomlinson-Keasey, 1972; Wason, 1968); and that the

acquisition of formal operational thought processes continues throughout the adult years (Piaget, 1972; Sinott, 1975; Tomlinson-Keasey, 1972). It does seem, however, that the college years often mark a time of dramatic change in many students' thinking processes and that this change should dictate, in part, alternative instructional modes for college professors.

A second implication of the principles outlined above is that one must begin with information which is meaningful to the student. New ideas which are presented in a manner which is partially consonant with the student's past experiences provide maximal possibilities for growth by facilitating the incorporation of these experiences into a new and stable set of concepts.

A final implication of the self-regulatory model is that the learner must be considered in all phases of planning and instruction. This places an enormous burden on insturctors who want to present information in a manner that is maximally beneficial to the student. One mechanism for dealing with this problem is to provide intimate classroom settings and small group learning experiences which promote close interaction of faculty and students. This permits the instructor to remain cognizant of the student's problems and successes in the learning area and exploits the use of peer group interaction as a learning tool.

The ADAPT Program

The theoretical overview provided and the implications that this view has for education can be translated more specifically into the college classroom. In a variety of Physics and Chemistry courses Piagetian principles have been used to analyze the way students approach the materials and solve physical problems (Beistel, 1975; 7

Herron, 1975; Karplus, 1970; McKinnon & Renner, 1971; Renner & Lawson, 1973). More recently the differences in thinking processes that characterize concrete operational students and formal operational students have become interesting to the social sciences and the humanities (Duly, 1976; Hardy, 1976; Narveson, 1976).

The ADAPT program goes one step further and combines six disciplines ranging from the sciences to the humanities. In each of six content areas--anthropology, economics, English, history, mathematics, and physics--courses have been devised which begin with concrete exploration activities and move gradually toward more abstract formulations. Following such exploration, the data are organized and are used to form hypotheses, to provide a basis for introducing concepts which are important to the field, and to provide a basis for generalization to other topics. With the background provided by these exploratory and invention activities, students are prepared to relate the concrete knowledge they have acquired to more abstract findings in the field, and to apply their knowledge to other areas.

This general model which divides the learning process into an active exploration phase, an invention phase, and an application phase has served as a basis for planning all class activities in the ADAPT program (Karplus, 1974). For example, some of the functional relationships in economics have been explored by having students receive yearly incomes in play dollars. They then allocate these dollars to various expenses, investments, etc. Looking at the relationship between the way that they have allocated money and the way various families and individuals in the society allocate money provides a basis for making

abstract concepts like price indices and inflation more meaningful.

The learning cycle, then, provides a vehicle for translating the concrete-formal distinction into specific classroom practice. Self-regulation, which is the focal mechanism for moving from concrete to formal thinking, is incorporated into the learning cycle by making students' experiences the basis for subsequent learning.

Another facet of the ADAPT program worthy of examination is the degree of its impact on students. The program was designed for maximum impact on the target population. The program is aimed particularly at freshmen because of their lack of experience in many of these content areas. In addition, all of the students in the ADAPT program selected their entire freshmen year's work from ADAPT courses and attended these classes as a group. Because ADAPT classes are small many group learning activities are carried out. In this context students can learn from other students and the professor can maintain close contact with the entire group. Finally, the multidisciplinary staff meets weekly to integrate the material that is being presented. By adopting this maximum impact strategy, it was hoped that the student would come to appreciate the flexibility and wide applicability of the thinking skills that are the focus of the program. Further, if successful, the ADAPT program should yield a population of students well prepared to investigate and analyze any body of content that they encounter during their college years.

Evaluation of the ADAPT Program

Evaluating the success of the ADAPT program involved delineating particular areas of student functioning where one would predict changes as a result of this program. First and foremost, we were interested in whether or not the students' abilities to think on a more abstract, formal level would be improved. Secondly, we were interested in whether or not they would show a different pattern of personality and social growth. Finally, it was expected that students in the ADAPT program would develop a very positive attitude toward college in general.

Two comparison groups of students were selected to provide some kind of standard of change during the freshman year. The first comparison group was composed of students who had applied to the ADAPT program but were not included in the final group of participants. These students enrolled in regular freshman courses at the University of Nebraska.

A second comparison group from the Centennial Education Program (Brown, 1972) was added in the spring semester. In this program

students are in small classes, they are encouraged to participate in class, they often know each other, and the professor usually knows them. Comparing this group to the ADAPT group seemed like a more reasonable test of whether the learning cycle as a curriculum organizer was effective in moving students toward more abstract thought processes.

In order to evaluate the affects of the freshman year on the three target groups--ADAPT students, Control students, and the Centennial students--the groups were first assessed on measures taken prior to their entrance to the University. A comparison of all students on ACT scores and high school quartile demonstrated the essential equivalence of all three groups.

Evaluation Instruments

The basic design of the evaluation was a pretest-posttest comparison of the ADAPT and Control groups and a posttest only comparison of all three groups (see Slide 1). Three different measures formed the basis of the

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Insert Slide 1 about here

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evaluation. To examine any changes in formal operational thought processes, a series of paper and pencil tests were devised, adopted from Inhelder and Piaget's (1958) original work on formal operations. These tasks examined the student's ability to (a) separate variables, (b) test variables in an unconfounded manner, (c) generate hypotheses systematically, (d) display proportional reasoning, (e) conduct critical tests of hypotheses, (f) demonstrate an understanding of probability, and (g) ascertain the relationship between two variables (Tomlinson-Keasey, 1975).

To examine personality changes and development in social areas, the conceptual complexity test developed by Harvey, Hunt and Shroeder (1961) was administered. This test deals with the adult's ability to conceptualize interpersonal and authority issues on increasingly abstract planes. Based on responses to sentence stems, a student is categorized into one of four stages. The lowest stage suggests that the individual conceptualized issues in black and white terms and is very concrete about the information utilized in his clearcut, simplistic handling of the issue. A score obtained at the highest level indicates the individual conceptualized the issue in more abstract terms, and is capable of assessing all the variables relevant to a problem. The formal operations measure and conceptual complexity measure were administered to the ADAPT and Control studnets in the Fall and to all three freshmen groups in the Spring. Finally to assess the student's attitudes toward various facets of University life the College Student Questionnaire Part II was administered. This standardized attitude questionnaire is published by the Educational Testing Service. A student's responses to the multiple choice questions are summarized into scores on eleven dimensions. These include a look at (a) how the student perceives his family and his peers, (b) the student's perception of the society in general, (c) the student's satisfaction with the University environment, and (d) how the student balances studying with extracurricular involvements. All three of the freshmen groups responded to this test during the Spring Semester.

The means and standard deviations of the three freshmen groups on the formal operations measure are presented in Slide 2 .

Insert Slide 2 about here

A 2 x 2 analysis of variance with repeated measures comparing just the ADAPT and Control students on formal operational thought indicated that on three of the subtests and the composite measure, the ADAPT students scored significantly higher than the Control students [F (1,55)= 8.06, $p<.01$; $F(1,55) = 9.11$, $p<.01$; $F(1,55) = 3.17$, $p<.05$; and $F(1,55)=$ 6.72, $p<.05$ for the number produced, systematic strategy, correlation and the composite score respectively] . Both groups made significant improvements during the year on (a) generating combinations, (b) using a systematic strategy, (c) conducting critical tests, and (d) solving correlational problems [$F(1,55) = 12.56, 6.35, 9.44$, $p<.01$ and $F(1,55)=$ 3.95, $p<.05$ respectively] . These results suggest that the freshman year is a time of intellectual growth for all students but that the ADAPT students made progress over and above that typically seen during the freshman year. There is a hazard to this analysis, however, since the ADAPT students scored significantly higher on the pretest than the Controls.

To control for any bias this might have introduced, it was decided to look at the performance of a group of ADAPT students who were matched with Control students on pretest scores. Such a matched pairs

analysis showed that the ADAPT students scored significantly higher than the Control students on the posttest t (19) = 3.38, $p < .01$. This somewhat truncated sample indicates that the ADAPT students are learning how to think abstractly and perform formal operations at a pace that is not matched by the Control students.

The Centennial students' scores on the posttest are compared with the ADAPT and Control groups' scores in Table 1. A signigicant difference exists between groups on four of the eight subtests. The ADAPT students score higher than the other groups on all of these subtests and their superiority to the other two groups on the composite score is clear.

The formal operations tests administered and described above concentrate on logical, systematic, and deductive kinds of thought processes. The analysis of these tests indicated that, in general, the ADAPT students evidenced more of these characteristics after their freshman year than the other two groups. There is, however, more to adequate conceptual functioning in American Society than logical, deductive abilities. In fact, other investigators have argued that personality development and the development of social skills are a critical acquisition of the college years (Brown, 1972; Loevinger, 1976; Perry, 1968).

As the year progressed, the ADAPT students showed marked changes in personality skills and the level of their social interactions. It was hoped that the conceptual complexity measure would provide a more systematic documentation of the staff's subjective impressions that many such changes were occurring.

Slide 3 shows the means and standard deviations of the three groups. Comparing only the ADAPT and Control students, we see a slight downward shift during the year in the Control students.

Insert Slide 3 about here

The ADAPT students on the other hand show a substantial increase resulting in a significant interaction $F(1,52) = 6.68$, $p < .02$ between the two groups and the pretest and posttest. A comparison of all three groups on the posttest shows that both the ADAPT and Centennial students scored significantly higher on this measure than the Control subjects.

Since growth in this area is seen as a function of interpersonal skills, it is appropriate to ask what characterized the ADAPT and Centennial students that might facilitate such growth. One possible answer is that both groups are in social clusters. The ADAPT students attend all of their classes together. Many of the Centennial students live in the dormitory associated with the Centennial Education Program. Perhaps it is the depth of the social interaction with another group that fosters conceptual growth. However, the Controls also had intimate friends as well as circles of acquaintances. Another major difference seems to be that the ADAPT and Centennial students interacted together in class settings as well as outside of class. A third difference that may be very influential is the small classes and the concomitant level of interaction with professors. Perhaps

this kind of personal interaction encourages students to conceptualize issues in a more differentiated and abstract way.

One of the critical components of the Freshman year seems to be the student's attitude toward school. In fact, positive or negative attitudes about their college experience are often critical factors in whether students decide to drop out of school or remain in it. For this reason the attitudes of all three groups of students were assessed on the College Student Questionnaire Part II. Scores on eleven scales are derived from the student's responses to this questionnaire. The scores for the three freshmen groups in the present study are presented in Slide 4.

Insert Slide 4 about here

The satisfaction with faculty scores indicate that the ADAPT students are clearly more satisfied with their instructors than the Centennial students $t(55) = 2.08$, $p < .05$.

An overall summary of the first year of the ADAPT program would have to be that the program seems to have been moderately successful at achieving its goals. ADAPT students made significantly more gains in the realm of logical and abstract thinking than a matched group of Control students. In addition they seem to have learned during the year to conceptualize issues in a more differentiated way than the Control subjects. Their attitudes toward their social and academic experiences are quite favorable and they seem to have gained satisfaction from their interaction with both faculty and students. These changes are especially encouraging when one considers that over one third of the students were from the bottom half of their graduating class. The documentation of change along these several dimensions gave rise to cautious optimism that programs like ADAPT may facilitate the kind of logical, abstract thinking that is so prized in our society.

SECOND YEAR EVALUATION

At the end of the first year of the ADAPT program we found that ADAPT students demonstrated significantly more ability at formal reasoning processes than a group of matched control subjects. It was further shown that the ADAPT students increased on a test of conceptual complexity while the control group decreased slightly. Finally, ADAPT students demonstrated very positive attitudes toward the faculty and their college experience. In short, it seemed that the goals of the ADAPT program were attained in the first year (Tomlinson-Keasey and Eisert, 1978).

Hence, it was decided that during the second year we should use more stringent measures of success. The measurement of change in abstract or formal operational thinking skills provides an example. During the first year a number of tasks were used which had been developed for research purposes. Although these tasks were theoretically geared to assess formal operational thought, they did not meet strict test construction requirements. It seemed that other nationally standardized tests of critical thinking might demonstrate more convincingly the value of the ADAPT program in fostering thinking skills. Hence, a nationally normed, objective test--the Watson Glazer Critical Thinking Appraisal--was administered during the second year.

A similar change with respect to the measure of personality development occurred. During the first year a test of conceptual complexity was used. This test, although used widely to assess interpersonal development, does not meet the parametric requirements typically demanded of nationally normed assessments. Here again, it was decided that ADAPT's success could be demonstrated convincingly if a more rigorous assessment was used. Hence, Jane Loevinger's measure of Ego Development became a part of the second year evaluation.

The thoughts of the evaluation team and project staff concerning the second year evaluation are reflected in these changes in measures. In essence, it seemed that the program successfully met its goals during the first year of its operation. In order to argue for wider dissemination of the principles of the ADAPT program, however, we felt compelled to put the program to a more rigorous evaluation. The results of this evaluation are reported in subsequent sections. The evaluation instruments used, the different groups of subjects involved in the assessments, and the times when various tests were administered are depicted in Slide 5. In subsequent sections the tests and subject samples are described and the rationale for the design is given.

SLIDE 5

Design of the Second Year Evaluation

	ADAPT		Control[1]		Centennial		Control[2]	
	F 76	S 77	F 76	S 77	F 76	S 77	F 76	S 77
Initial Measures								
ACT Scores	X		X		X		X	
H.S. Quartile	X		X		X		X	
Watson-Glazer Critical Thinking Appraisal	X	X	X	X	X	X		
Formal Operational Assessments	X	X					X	X
Jane Loevinger's Ego Development	X	X	X	X	X	X		
Omnibus Personality Inventory	X							
Attitudes toward Faculty		X		X		X		

Instruments

1. Watson-Glazer Critical Thinking Appraisal. This test consists of a series of exercises which require the application of some of the important abilities involved in critical thinking: inference; recognition of assumptions; deduction; interpretation; and evaluation of arguments. In addition, the critical thinking appraisal calls for responses to two different kinds of items. In some items the student confronts problems involving neutral topics about which people generally do not have strong feelings. Other items, approximately parallel in logical structure, pertain to political, economic, and social issues which are more likely to arouse emotional feelings, biases, or prejudices (Watson & Glazer, 1964).

This test has been administered to 5,675 freshmen in 16 liberal arts colleges. Hence, norms for the performance of freshmen are available. In addition, reliability and validity data have been compiled. Finally, the Watson-Glazer is available in multiple forms. Using two forms for pre- and post-testing has the advantage of minimizing any practice effects.

In essence, the use of the Watson-Glazer Critical Thinking Appraisal allows for a rigorous test of whether any changes have occurred in thinking skills as a result of the ADAPT program. It is hypothesized that the ADAPT students will show significantly greater increases on the Watson-Glazer Critical Thinking Appraisal than the Control or Centennial subjects.

2. Formal Operational Tasks. The instruments used to assess formal operations consisted of five tasks which require proportional reasoning, isolation and separation of variables, correlation, and probability (Campbell, 1977). This test is designed to assess the theoretical formulations of Jean Piaget. Our goal in using this type of assessment was to adhere as closely as possible to theoretically meaningful assessment procedures.

3. Attitude toward Faculty

To assess the students' attitude toward faculty, that subscale of the College Student Questionnaire, Part II was administered. This standardized attitude questionnaire allows for comparisons between the ADAPT, control, and Centennial samples as well as a comparison of the three groups with a national sample. The specific hypothesis to be investigated is that the ADAPT population has more positive attitudes toward the faculty than the Control 1 group or the Centennial students.

4. Omnibus Personality Inventory.

This personality test emerged from the extensive work on college student development by Sandford (1956) and his associates at Vassar after World War II. Extensive data have been accumulated concerning this test by the staff of the Center for Research and Development in Higher Education at Berkeley. The test was selected because it examines both the intellectual and emotional aspects of personality. However, since it is more likely to indicate personality development over a long period of time, it was decided that it should not be administered a second time until the junior or senior year.

5. Ego Development

A test which is somewhat more likely to show short term development is Jane Loevinger's Measure of Ego Development. This instrument indicates the degree to which mature personality characteristics have developed. In effect, personality is charted through various response types, each one characteristic of students whose personal development has progressed to a similar degree. This assessment, like the Watson-Glazer, has a long history of use and seems to be one of the most reliable and valid indices of personality development that is currently available (Loevinger, 1976). In addition, the theoretical and developmental

aspects of this test mesh nicely with the principles of the ADAPT program. In short, the results of this test given during the fall and spring should provide a rigorous test of the hypothesis that the ADAPT program facilitates affective development.

6. Initial Measures

Since the selection procedures for the four groups of subjects did not guarantee a random sample of the entering class of freshmen, it is important to know how the groups differ on initial characteristics. The pre-test assessments will, of course, give some indication of the differential standing of the four samples. In addition, it is possible to compare all four groups on the American College Test (ACT) and high school standing. The ACT has the advantage of being a widely used and well standardized test, enabling us to compare our groups to national norms. Such comparisons may help establish the generality of our results.

Subjects

A total of four different groups of subjects participated in the 1976-77 evaluation. Three of these groups, ADAPT, Control, & Centennial students were similar to the first year evaluation.

As indicated in Slide 5, these three groups (ADAPT, Control, and Centennial) participated in the Critical Thinking and Ego Development testing during both the Fall of 1976 and the Spring of 1977. In addition, attitudes toward faculty were measured in the Spring in all three groups.

Because the ADAPT program was designed to increase formal operational thinking and because there were no preliminary indications of how these abstract thinking skills might correlate with those processes measured on the Watson-Glazer Critical Thinking Appraisal, it was decided that a separate comparison of movement on formal operations would be appropriate. Two sections of the

same introductory physics course, one containing ADAPT students, and one composed primarily of sophomores who received a traditional physics course (Control group 2) made this comparison possible. The test of formal operations was administered as part of the physics laboratory in the fall and spring.

RESULTS

The results are divided into five sections: (a) a comparison of groups on initial measures; (b) an evaluation of changes in thinking skills; (c) an evaluation of changes in personality development; (d) a comparison of attitudes toward faculty; and (e) a compilation and summary of two years of the ADAPT program.

Initial Measures

In Slide 6 the means and standard deviations of all 4 groups of students on the ACT are presented.

Slide 6

Means and Standard Deviations of Four Groups on ACT

	ACT Composite	Eng	Math	Social Science	Natural Science
ADAPT n=31	20.22 (4.70)	17.61 (4.42)	19.71 (6.08)	22.77 (5.75)	20.10 (6.56)
Control 1 n=34	24.12 (5.54)	21.68 (5.53)	23.29 (8.26)	26.44 (5.67)	24.56 (5.89)
Centennial n=24	23.21 (6.01)	21.50 (4.63)	22.58 (9.57)	24.79 (7.03)	23.63 (6.63)
Control 2 n=13	23.85 (3.56)	20.92 (5.30)	25.77 (4.42)	25.15 (5.47)	23.23 (5.02)
All UNL Freshmen n= 3,000	21.2	19.0	21.6	20.1	23.4
Nationwide sample n=48,808	18.5	17.6	17.8	17.4	20.9

The disparity between the scores of the ADAPT students and all three of the other control groups is obvious. The ADAPT group's scores are significantly lower than the other three groups on the composite measure.

The ACT scores confirm the fact that the ADAPT group is less able in a variety of content areas than the other three groups of students that were followed in the present study. The Centennial students who, on the basis of high school rank, might be expected to do poorly on the ACT did not differ from the $Control_1$ or $Control_2$ subjects.

It seems clear from these initial measures that the students selecting the ADAPT program were not as well prepared for college as the other three control groups. Their ACT scores are also lower than the overall freshman class entering the University of Nebraska at Lincoln.

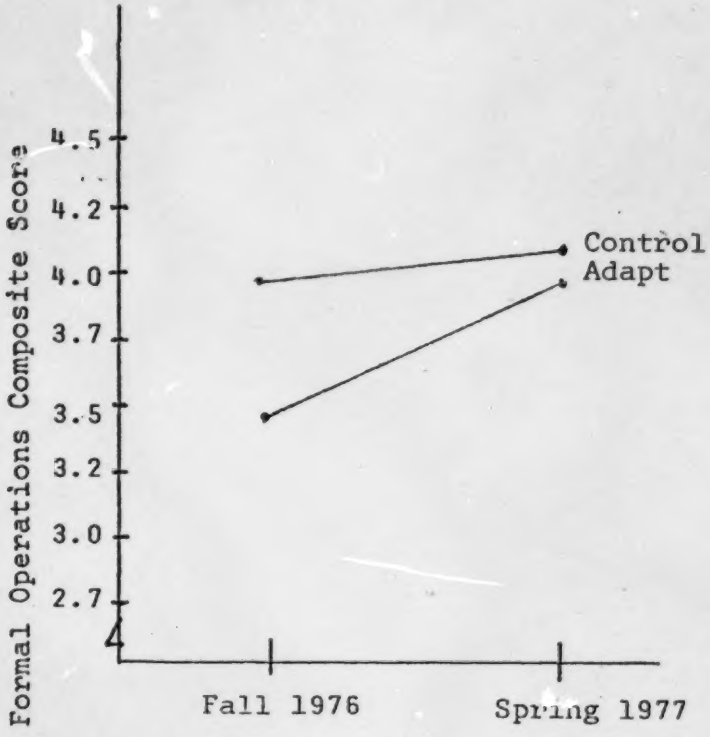
Changes in Thinking Skills

The ADAPT group and $Control_2$ group were administered five different formal operational tasks in the fall and the spring of the year. On each of these tasks, students could receive a score from 1 to 5. In each case a score of 1 or 2 meant that a student relied primarily on concrete thought processes to solve the problem; a score of 3 or 4 indicated that the student was in transition from concrete to formal operations; and a score of 5 meant that the student used formal operational thought in solving the problem. A composite score obtained by averaging a student's performance across all five tasks gives a global indication of the kinds of thought proceses students used to solve a variety of problems.

As indicated in Slide 7 this composite score shows that the two groups differed significantly $F(1,48) = 5.19$, $p < .03$ and that there was a significant increase in formal operational skill from fall to spring $F(1,48) = 28.49$, $p < .01$. These results document increases in formal operational skills for both groups from fall to spring. Such a change should certainly be expected during the course of a year in college. In addition, this analysis demonstrates a significant difference between the ADAPT and $Control_2$ subjects. The initial measures reported earlier revealed a significant disparity between the ADAPT and $Control_2$ subjects. Hence, it is not surprising that the ADAPT students scored somewhat below the

Control$_2$ students on the pretest. The significant interaction between the groups and the the pre- and post-tests, however, indicates a differential increase during the year in the two groups $F(1,48) = 4.32$, $p < .05$ Basically, this result, depicted in Slide 7, indicates that the ADAPT students showed more substantial increases in formal operational thought than the control subjects.

Slide 7



Slide 7. Changes in Formal Operational Thinking

The Watson-Glazer Critical Thinking Appraisal was also administered to chart the effect of the ADAPT program on thinking skills. Forms Y and Z of the Watson-Glazer were administered in the Fall and Spring respectively to ADAPT, Control$_1$, and Centennial students. Although these two forms are equivalent when percentile scores are used, the

raw scores on form Z are somewhat lower than the raw scores on form Y. Hence to avoid showing a spurious drop in raw scores all post-test scores were converted into scores equivalent to the pre-test form. The means and standard deviations of the three groups are presented in Slide 8.

Slide 8

Means and Standard Deviations of
Watson-Glazer Test Scores

	ADAPT	$Control_1$	Centennial
Pre-test	63.60 (8.23)	74.54 (8.39)	73.75 (10.09)
Post-test	73.26 (10.49)	74.97 (10 02)	74.00 (11.70)

A repeated measures analysis of variance indicates that the interaction between the three groups and the two tests is significant $F(2,95) = 4.13$, $p < .019$. This indicates that the ADAPT students made significant gains during the year while the other two groups did not. Althought the ADAPT students were less able on the pre-test, by the end of the year they had improved significantly in critical thinking skills and their scores now equaled the scores of the other two groups.

In this section of the results the ADAPT students have been compared with three other groups on two measures of abstract thought. In all of these comparisons the ADAPT students have shown increases in thinking skills that were not matched by the comparison groups. One can attribute these increases to the methods and rationale underlying the ADAPT program but there is at least one alternative explanation that

warrants consideration.

These results could be a function of a ceiling level on the measures used. In other words, the control students who on the pre-test were far superior to the ADAPT students might not have been able to improve their scores on the post-test. Considering this criticism for the formal operations measure we see that the control students composite score was 3.95 on a scale of 5. However, an examination of the subscales reported in Table 4 indicates that on only one of the tests had the control group really reached a ceiling level. Therefore, they could have shown movement on the other four post-tests. Another factor which seems to render this criticism inapplicable to the formal operations test is that the ADAPT group had also reached a ceiling on the post-test of the metric puzzle. On the critical thinking appraisal, the control students' post-test scores were approximately 73 out of a possible 100. National norms indicate that students scoring in the upper 10% of the population receive raw scores of 79-89 with a raw score of 89 representing the 99th percentile. The control group should have been able to achieve raw scores in the 79-89 range if their critical thinkings skills had improved. Hence, it does not seem likely that a ceiling effect can account for the lack of change demonstrated by the two comparison groups on the critical thinking measures.

Another explanation, buttressed by the first year ADAPT evaluation results, is that the ADAPT curriculum is designed to foster critical thinking skills while a more typical freshman curriculum does not.

Personality Development

The changes in Jane Loevinger's measure of ego development from fall to spring are depicted in Slide 9. An analysis of these means indicates no significant change on the part of any of the groups.

Slide 9

Means and Standard Deviations of
All Groups on Ego Development

	ADAPT		Control		Centennial	
	Male	Female	Male	Female	Male	Female
Pretest						
$\bar{X}$	4.95	5.47	5.38	5.48	5.06	5.64
σ	.78	.52	1.41	.70	1.64	.67
Posttest						
$\bar{X}$	4.84	5.13	4.88	5.48	5.06	5.09
σ	1.46	.60	1.36	.89	1.25	.83

One can conclude that the ADAPT program did not foster any substantial changes in personality development as measured on this test.

Attitudes toward Faculty

In the first year evaluation of the ADAPT program, attitudes toward ADAPT faculty were very favorable. Since such attitudes permeate a student's college career, the second year evaluation looked again at ADAPT, Control, and Centennial students' attitudes toward faculty (subscale of College Student Questionnaire, Part 2). The difference between the three groups' attitudes, reported in Slide 10, are highly significant $F(2,91) = 14.29$, $p < .001$

Slide 10

Attitudes toward Faculty

	ADAPT	Control	Centennial
$\bar{X}$	36.03	30.57	37.71
σ	4.75	5.89	6.13

Both the ADAPT and Centennial students gave very favorable ratings to the faculty while the Control students, involved in larger classes and typically experiencing much less interaction with the faculty, are not as favorably disposed toward the faculty.

These attitudinal results by themselves might suggest that the variables of interest are quality faculty and small classes. However, when these results are examined in concert with the changes in thinking skills presented earlier, we do not see substantial increases in the Centennial group. Hence, one can conclude that something other than quality faculty and small classes is operating to effect the changes in the ADAPT students. We would like to suggest

that a critical variable is the curriculum which demands that the student (a) engage in some exploration of an area, (b) relate his explorations to meaningful experiences, and then (c) apply these concepts broadly.

COMPILATION AND SUMMARY OF TWO YEARS OF THE ADAPT PROGRAM

The two years of the ADAPT program have been very different in many ways, yet some of the same patterns of growth have emerged. In this section an attempt is made to compare the findings from the two years and summarize them.

The two groups of ADAPT students are compared on ACT scores in Slide 11. While the composite scores are not significantly different, this year's group of ADAPT students received lower scores than last year's on all of the sub-tests except social science.

Slide 11

Means and Standard Deviations of
ADAPT Groups on ACT

		Composite	Eng	Math	Social Science	Natural Science
ADAPT 75-76	$\bar{X}$	21.24 4.94	18.85 4.99	20.85 6.93	21.29 5.78	23.81 5.81
ADAPT 76-77	$\bar{X}$	20.22 4.70	17.61 4.42	19.71 6.08	22.77 5.75	20.10 6.56

Perhaps one could argue that the 1976-77 group of ADAPT students was not as well prepared for college as the 1975-76 group. The fact that students from both years showed improvements in abstract thought that were not paralleled by students enrolled in a more traditional

curriculum seems to argue that the ADAPT program can provide a focus for facilitating the development of critical thought processes across a broad spectrum of student abilities. In both years of the program we see that students in the ADAPT program have a much more favorable attitude toward the faculty than students in a traditional curriculum.

In short, the second year of the ADAPT program, evaluated by means of better standardized and sounder assessments, largely confirmed the findings of the first year. The ADAPT program seems to create a climate for exploration that positively influences student development along intellectual dimensions. These students, by being responsible for their learning, have acquired new thinking skills and have learned to savor the accomplishments that accompany the use of these skills.

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